3.3 Vertical Motion Stage

Figure 3 shows the vertical motion stage mounted on top of the Huber goniometer. This stage consists of upper and lower plates separated by four uprights. Each upright houses two linear bearings riding on a vertical slide shaft. Two linear actuators, driven by stepper motors, move the lower plate in the prescribed range of ±25 mm. The lower ends of the actuators' rods are inserted into preloaded spherical bearings to compensate for slight angular misalignment during travel. These bearings are assembled in a plate that is fastened to the top of the goniometer. Motion resolution for a half step of the stepper motors is 8 μm. The stepper motors are synchronized electronically with a motion controller as well as mechanically with a timing belt.

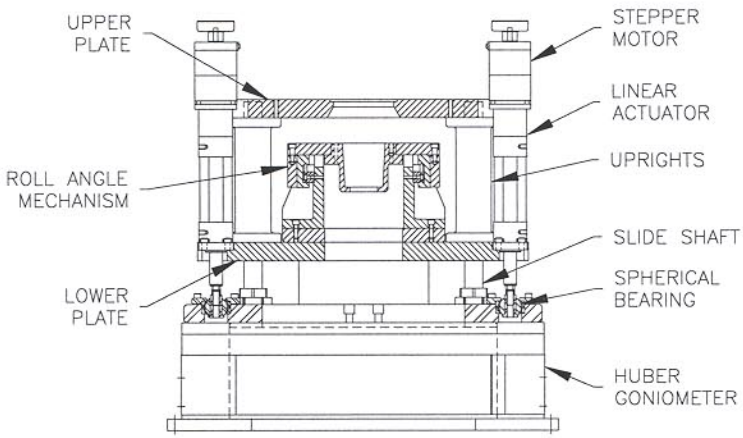

Fig. 3: Vertical motion stage mounted on the Huber goniometer.

3.4 Roll Angle Mechanism

The roll angle χ is implemented by using two parallel radial tracks in vertical orientation (Fig. 4), each with a radius of 400 mm. The tracks are fastened to a frame that is bolted to a mounting plate attached to the vertical motion stage. Radial centers of the tracks are in line with the center of the beam on the crystal. This eliminates "beam-walking" when the crystal is rotated.

As shown in Fig. 4, a linear actuator and a stepper motor are assembled in a bracket using a belt drive to save space. Double nuts on the actuator are tightened against each other to eliminate backlash. The nut assembly is connected with a bracket to the saddle that rides on the radial tracks. Both the actuator and the nut assembly can pivot inside their respective brackets to account for small changes in angles as the saddle travels on the radial tracks. The saddle has a tapered cavity in the center that captures the base of the crystal holder's shaft by tightening a tapered collar. This mechanism provides an angular resolution of 0.0001° and a range of ±3°.